

FINAL REPORT

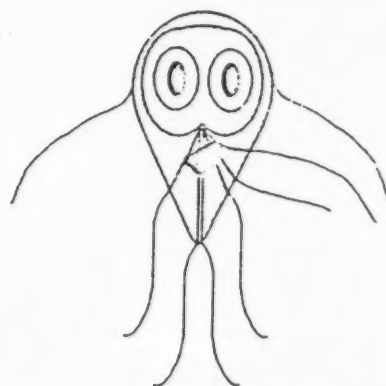
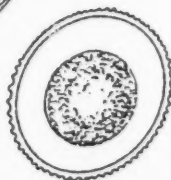
TO THE

ALBERTA ENVIRONMENTAL
RESEARCH TRUST

PARASITES OF DOGS AND CATS
IN ALBERTA

and

GIARDIASIS



SUBMITTED BY:

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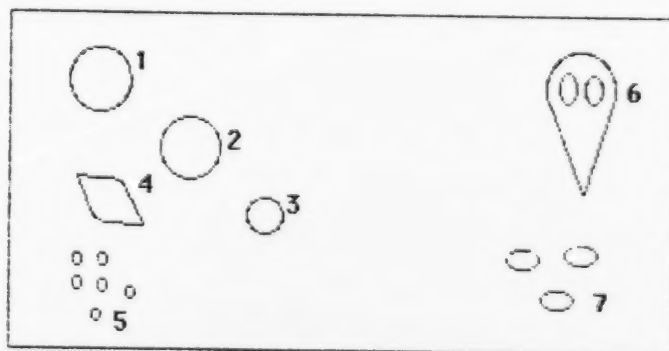


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FINAL REPORT TO THE A.E.R.T.

1.0 Executive Summary

Over 1,200 canine stool samples from Edmonton, Red Deer, Calgary, Lethbridge and Medicine Hat, and 235 feline samples from Edmonton, Calgary, Lethbridge and Medicine Hat, were examined for evidence of infection with protozoans and helminths. Of these, 281 (23%) of canine and 29 (12%) of feline samples were found to be infected with one or more species of parasite. The most common parasites in both dogs and cats were protozoans; a flagellate, Giardia sp., in dogs, and coccidians in cats. A marked increase in the prevalence of Giardia sp. infection in Edmonton dogs occurred during an outbreak of human giardiasis in that city in February, 1983.

In the laboratory, attempts to infect gerbils with the cysts of canine-source Giardia sp. were unsuccessful, but this result is inconclusive. We confirmed that gerbils would serve as laboratory hosts for human-source G. lamblia, that infected gerbils would appear to lose their infections in 30 days or more, and that such apparently "self-cured" gerbils would show a recrudescence of infection following immunodepression with cortisone as much as six months after initial infection.

2.0 Introduction

2.1 Historical

The work reported here stems from earlier A.E.R.T-funded research on dog and cat parasites in Lethbridge and several nearby communities in which I showed that the prevalence of helminth infection was markedly higher in animals incarcerated in municipal shelters than the general dog and cat population because animals which roam at large most of the time are most likely both to become infected and also to be caught by animal control officers.

2.2 Application History

As a result of this initial work, it was clear that shelter animals represented the best source of information about dog and cat parasites. Thus, I applied to the Trust for funding to survey the intestinal parasites of shelter animals in the major population centres in Alberta. At the same

time, because of interest in human giardiasis in Alberta related to a then-current outbreak at Banff National Park, part of the application dealt with giardiasis and public water supplies.

In retrospect, my proposal to attempt recovery of Giardia cysts from water supplies was ill-advised. First, even if I were to recover cysts, it would have been impossible to determine whether or not they represented a species capable of infecting humans (some species of Giardia can infect only certain rodents). Secondly, I was shortly to discover that work being done by Dr. P. Wallis, Kananaskis Environmental Research Centre, University of Calgary, utilized a technique which was far superior to the one I had proposed. At the same time, I discovered the presence of Giardia cysts in a surprisingly large percentage of dogs in Alberta, and it became compelling to pursue this unexpected finding. Thus, the giardiasis portion of the present research changed in its thrust and direction: I decided that the most fruitful avenue of research was to examine the question of prevalence in dogs, and the related question of whether the cysts from dogs were infective to humans. This led first to the survey of Edmonton dogs during the human outbreak there, and second to the gerbil work reported here. (G. M. Faubert and M. Belosevic of McGill University had shown that gerbils were excellent laboratory hosts for human source Giardia lamblia.) If gerbils could be infected with cysts from dogs, it would provide indirect evidence that dog-source cysts also might be infective to humans.

3.0 Materials and Methods

3.1 Study Localities

Five major urban centres in Alberta were selected for study: Edmonton, Red Deer, Calgary, Lethbridge, and Medicine Hat. In Lethbridge and Medicine Hat, my assistants and I collected our own samples, whereas in the other localities, arrangements were made with cooperating personnel at municipal animal shelters for the collection and shipment of stool specimens from dogs. In addition, the cooperation of personnel at S.P.C.A. shelters in both Edmonton and Calgary was obtained. Feline samples were obtained from the municipal shelter in Lethbridge, and from the S.P.C.A. shelters in Calgary and Edmonton. Cooperating shelter personnel are acknowledged in Section 7.

3.2 Collection & Processing of Samples

In Edmonton, Red Deer and Calgary, shelter personnel were instructed in proper collection methodology and related personal hygiene. Stool samples were collected individually in numbered plastic bags which were tied and placed in sturdy plastic buckets. These were secured with fibreglass tape. Data sheets were taped in an envelope on the outside of the bucket, which was then transported weekly to the University by a courier. Transit time usually was 24-36 hours. Upon arrival at Lethbridge, samples were unpacked, checked against the data sheets, and refrigerated at 4 C until study. Procedures differed slightly from before: we did not use direct smears, but utilized the MIF centrifugation technique and the zinc sulfate flotation technique described in the previous study. Reference material was preserved as (1) permanent stained smears, (2) potassium dichromate vial samples, and (3) sodium acetate, acetic acid, formalin (SAF) vial samples. These represented a backup for re-examination of enigmatic finds. Each week, copies of completed report sheets were returned to participating shelters, providing them with on-going feedback on which animals were infected, and the identity of the parasites they harbored.

3.3 Summary of Samples Collected

3.3.1 Dog Samples

Over 1,200 canine stool samples were collected and examined during the summer of 1982. The sources of these samples are summarised in Table 1.

3.3.2 Feline Samples

A total of 235 feline stool samples were examined from the following Alberta centres: Edmonton, 53; Calgary, 92; Lethbridge, 44; and Medicine Hat, 46.

3.4 Giardia Laboratory Work

3.4.1 Isolation & Concentration of Cysts

Cysts for experimental work were obtained from naturally infected dogs or humans (the latter through the cooperation of the

Lethbridge Regional Hospital). Cysts were concentrated following a modification of the methods of Roberts-Thompson *et al.* (1982) using a sucrose gradient centrifugation technique. For infections, cysts were collected from relatively fresh stools, and were used to infect experimental hosts immediately following concentration.

3.4.2 Gerbils

Gerbils, Meriones unguiculatus, were obtained from Tumblebrook Farms, Maine; these or their progeny were used in all experiments. Prior to use in infection experiments, young (6-10 week old) males were first premedicated by gavage with metronidazole at 250 mg/kg/day for 3 or 4 days to remove any enteric helminths or flagellates they might harbor. Medicated animals were rested for about one week, and then were infected by administration of 100,000 cysts of human- or dog-source Giardia cysts by stomach tube. Prior to infection, selected animals were killed by carbon dioxide inhalation and their intestines examined to verify that they were free from infection. The course of infection in the gerbils was monitored by fecal examinations to demonstrate the presence and numbers of cysts; the location of trophozoites (active, feeding forms) was checked in three infected animals by examining the opened small intestine.

Infected gerbils which apparently had self-cured were challenged by a second exposure to 100,000 human-source cysts per animal, and were monitored by stool examinations. Some animals which had shown an apparent self cure, and some which had been resistant to challenge, were immunodepressed by subcutaneous injection of hydrocortisone acetate at 150 mg/kg/d for either 3 or 4 days. The effect of immunodepression was monitored by daily fecal exams.

4.0 Results

4.1 Stool Survey -- Dogs

The results of this survey are presented in Table 2. The overall prevalence of infection was 23%, and the range (on a community by community basis) was 5% (Medicine Hat) to 41% (Lethbridge). The greatest number of parasite species occurred in samples from Calgary, where all the canine species of dog parasites reported here were found.

The most common parasite in all localities except Edmonton and Medicine Hat was the flagellated protozoan, Giardia sp. (Table 3).

Prevalences of Giardia sp. from Edmonton and Calgary are based on data pooled from Municipal and S.P.C.A. shelters in these cities. Prevalences by shelter source are given in Table 4. In Edmonton, the prevalence of Giardia sp. was 2.5 times higher in S.P.C.A. shelter samples than in Municipal Shelter samples.

The intestinal roundworm, Toxocara canis, was present in each of the communities studied; its overall prevalence was 4%, with a low of 2% (Lethbridge) and a high of 6% (Edmonton).

The northern hookworm, Uncinaria stenocephala, was far more common than the southern hookworm, Ancylostoma caninum, and its prevalence was greater in the more northern centres.

A curious record of eggs resembling very closely those of a species of Ascaris, normally a parasite of humans or pigs, was recorded six times in dogs from Calgary and Edmonton.

4.2 City-by-City Results (Table 2)

4.2.1 Edmonton

Most (60%) of samples came from the Municipal animal shelter; the remainder came from the S.P.C.A. Shelter. The total prevalences of infection for samples from the two shelters were 26% (Municipal) and 29% (S.P.C.A.).

A total of 102 (28%) of the 368 canine stool samples from Edmonton were positive for infection with intestinal parasites. The most common parasite was the nematode, Toxascaris leonina (12%), followed by Toxocara canis (6%) and Giardia sp. (5%). As noted in Sec. 4.3, below, that the prevalence for Giardia sp. increased during the human outbreak in the first quarter of 1983.

4.2.2 Red Deer

The most common parasite was Giardia sp. (7%), followed by the coccidian parasites (collectively 6%), the northern hookworm, Uncinaria stenocephala, (5%) and the ascarid roundworms, Toxocara canis and Toxascaris leonina (4% each).

4.2.3 Calgary

Most (66%) of the 310 Calgary samples came from the Municipal animal shelter; the remainder came from the S.P.C.A. shelter. The overall

prevalence for Calgary was 25%; that for the Municipal shelter was 22%, and that for the S.P.C.A. shelter was 31%. The most common parasite was Giardia sp. (12%), followed by Toxascaris leonina (6%) and Toxocara canis and Isospora spp. (5% each).

4.2.4 Lethbridge

A total of 33 (41%) of the 81 samples from the Lethbridge Municipal Animal Shelter were infected. The vast majority of these (33% of all samples) were Giardia sp., followed by Isospora spp. (6%) and the ascarid roundworms, Toxocara canis and Toxascaris leonina (2% each).

4.2.5 Medicine Hat

A total of 10 (5%) of 213 samples were positive; the most common of these was Toxascaris leonina (4%), followed by Toxocara canis and Isospora spp. (2% each). Medicine Hat samples showed the smallest number of parasite species of any study locality, as well as the lowest overall prevalence.

4.3 The Edmonton Giardiasis Outbreak

In first quarter of 1983, a major outbreak of human giardiasis occurred in Edmonton. During the outbreak, in February, 1983, I obtained stool samples from 99 dogs in the Edmonton municipal shelter, in order to compare the prevalence of Giardia in these dogs with data from the previous summer (when there was no human outbreak). The results (Table 5) show that the prevalence of Giardia sp. in dogs from the Municipal animal shelter in Edmonton was 5 times greater during the outbreak (17.2%) than during the previous summer (3.2%).

4.4 Gerbil Infections

4.4.1 Naive Animals

A total of 17 of 18 (94%) young male gerbils became infected with human source G. lamblia when exposed by stomach tube to 100,000 cysts. Infections (defined by presence of cysts in stool samples) lasted for up to 2 months. Prepatent period (the time between exposure to infective cysts and the presence of cysts in the feces) was 6-10 or more days. Infections peaked in the second week postexposure, at which time active feeding

forms (trophozoites) were found in all three regions of the small intestine; later on, trophs were found only in the first third of the small intestine, the duodenum.

4.4.2 Challenge Infections

Because gerbils appeared to "self-cure" in one to two months, and had been reported to remain immune to challenging reinfections for up to six months, challenge infections of 100,000 human-source cysts were given in January, 1984, to 4 animals which had been infected initially 5 months earlier (August, 1983). None of these animals showed the development of a patent infection as a result of the challenge. Five of 6 young, naive control animals, however, became infected when given identical doses of cysts from the same source, thus demonstrating that the challenge cysts were infective.

4.4.3 Immunodepressed Animals

4.4.3.1 Young Animals Just Recovering From Infection

Five young males, just recovering from initial infections, were immunodepressed on days 50 to 53 after their initial infections; 4 of the 5 showed marked recrudescence of their infections following administration of cortisone (see example, Fig. 1).

4.4.3.2 Older, Unsuccessfully Challenged Animals

Four animals which had been infected initially in August, 1983, and which had been resistant to challenge infection in January, 1984, were given cortisone injections in April, 1984. Two of these showed dramatic recrudescence of infection (Figure 2) beginning 6 days after the start of immunodepression.

4.4.3.3 Older, Self-Cured Animals

Three animals which had been infected initially in August, 1983, which had "self-cured" within 2 months, and which had had no exposure to Giardia lamblia since August, 1983, were immunodepressed with cortisone 7 months later, in April, 1984. Of these, two showed recrudescence of their infections (Figure 3).

4.5 Cat Stool Survey

Table 6 summarises the results of the cat stool survey. A total of 29 (12%) of all cat stools were positive for parasites. Collectively, Isospora spp. were the most common feline parasites (9% overall), followed by the cat ascarid, Toxocara cati (4%), and taeniid tapeworms (unidentifiable as to species) (3%). Only one cat showed infection with Giardia sp.

5.0 Discussion

5.1 Dog Stool Survey

Most of the species of intestinal protozoans and helminths one would expect to find were present in this survey. As mentioned in the Final Report submitted for the previous grant, the absence of the dog tapeworm, Dipylidium caninum is unusual, but is given credence by the work of Holmes & Podesta (1968) which noted its absence in wild canids in forested areas in Alberta. The high prevalence of the intestinal flagellate, Giardia sp., is quite similar to prevalences reported in other canine stool surveys in North America (Table 7).

I had hoped to show that dog-source cysts would infect gerbils, which are known to sustain human-source infections, thus indirectly supporting the hypothesis that cysts from dogs are the same species as those from humans. I believe our negative results with dog-source cyst infections in gerbils are due to technical problems which we experienced early in our infection experiments, and do not indicate that these cysts are uninfected to gerbils.

I have referred to the parasite from dogs as "Giardia sp." because I do not know that it is the same species as that occurring in humans. In the past, the commonly held view was that each host species had its own species of Giardia; this view would regard the parasite of dogs, by definition, to be "Giardia canis". More recently, the degree of specificity shown by species of Giardia for their hosts has been hotly debated. The emerging view seems to be that, although some rodent species of Giardia may be quite specific for their hosts, at least the human species, Giardia lamblia, is capable of infecting a variety of host species, including some rodents (ranging from beavers and muskrats to gerbils and white rats). In all of these hosts, the human species exhibits a "claw-hammer" shaped median body, rather than an oval median body (characteristic of rodent species which are incapable of infecting humans). While I was unable to

obtain infection data showing that both dog- and human-source cysts could infect gerbils, I could see that the canine species had a claw-hammer type of median body. This, plus the concurrent increases in prevalence of Giardia in humans and dogs in Edmonton in the first quarter of 1983 (see next section) suggests that the species in dogs and that in humans are the same. This view is further supported by cross-transmission studies which indicate a fairly broad range of host specificity for human-source Giardia lamblia (Table 8).

Prevalences for taeniid tapeworms based upon stool surveys represent family identifications (species cannot be identified by their eggs), must be regarded as potentially dangerous (because they might be species of Echinococcus), and probably are falsely low, because survey methodology is poor for obtaining positive records for taeniid eggs.

5.2 The Edmonton Outbreak

The outbreak of human giardiasis in Edmonton in the first quarter of 1983 provided a fortuitous "experiment". I already had a substantial set of data for Edmonton dogs from the summer of 1982 which could serve as a "baseline" against which to compare Giardia prevalence data obtained during the human outbreak. The Edmonton Municipal Animal Shelter provided me with 99 samples from dogs caught during the peak of the outbreak. The methodology for analysis of these samples differs slightly from that used in the previous summer; if anything, it is slightly less efficient, thus making the comparison with Summer, 1982, data a conservative one.

Prevalence of giardiasis in dogs from the Edmonton Municipal Animal Shelter (only) in the previous summer had been 3.2% (Tables 4 and 5); of the 99 samples obtained during the peak of the human outbreak, 17 (or 17%) were infected. This constitutes an increase of more than five-fold over Summer, 1982. My interpretation of this data is not that dogs were being infected by humans, or the humans by dogs, but that both dogs and humans were exposed to the same infection source. Although the public health report on the outbreak stopped short of incriminating the water supply, it is, nonetheless, the water supply which remains the only credible source for an outbreak of such magnitude.

5.3 The Gerbil Studies

One of the difficulties in studying G. lamblia is that of finding a convenient laboratory model which can mimic the infection produced in humans. While several models have been proposed, one of the best recent ones is the "gerbil-Giardia" model proposed by Gaetan Faubert and Michael Belosevic, MacDonald College, McGill University. Some scepticism greeted Faubert and Belosevic's original report (Belosevic *et al.*, 1983) that human-source Giardia could be grown in laboratory gerbils. After discussion with Faubert and Belosevic, I realized that I could attempt confirmation of the gerbil-Giardia model, and at the same time obtain indirect evidence that the species of Giardia in dogs was (or was not) the same as that in humans, with one series of experiments. My students and I set out to do this in the summer of 1983. We obtained initial positive results in late August, 1983, and the experiments have continued until May of 1984.

We have confirmed the reports of Faubert and Belosevic that gerbils could be infected with human-source cysts of Giardia lamblia, that infected animals appear to self-cure in a month or two, and that such animals are refractory to a second (challenge) infection. The real significance of our work, however, is evidence that the resistance to challenge is not the result of a "sterile immunity" (as suggested by Belosevic *et al.*, 1983), but, rather, that it results from a continuing infection which is so low as to be undetectable by standard laboratory methods. The gerbils are not actually cured, but have on-going, extremely low level, infections which serve to keep their immune systems geared-up to prevent secondary (or challenging) infections.

This explanation, for example, helps to explain surveys showing that residents of Leningrad, U.S.S.R., have a very low prevalence of giardiasis, whereas visitors to Leningrad suffer a very high attack rate for this infection: the residents of Leningrad probably have very low level, undetectable, infections which provide the immunological basis for their concurrent immunity to natural "challenging" reinfections. The same explanation may be the basis for the anecdotal accounts of veteran hikers who claim to drink untreated stream water with no adverse results.

5.4 Cat Stool Survey

Although the absence of Dipylidium caninum is noteworthy, Alberta cats otherwise are infected with rather typical feline parasites. The records for taeniid tapeworms must be viewed with caution, however,

because the pathogenic species, Echinococcus granulosus and E. multilocularis, are known to occur in the Province, and their eggs cannot be distinguished from those of the more innocuous taeniid species. In fact, the actual prevalences of taeniids probably is higher than reported here because the stool survey methodology used in this research is relatively ineffective in detecting taeniid eggs.

6.0 Conclusions

1. Most of the common intestinal parasites of dogs and cats are present in these hosts in Alberta.
2. From a public health standpoint, Giardia lamblia and Toxocara canis are the two most serious parasites of dogs in Alberta; the latter has been shown to cause serious pathology and even death in humans, and the former may be the same species as that infecting humans.
3. It is not yet known whether the species of Giardia in Alberta dogs is the same as that in humans, although the human species is known to be capable of infecting dogs experimentally.
4. The conspecificity of human and canine species of Giardia is supported by the observation that the prevalence of canine giardiasis in Edmonton at the time of the human outbreak increased more than five-fold over the prevalence observed during the previous summer, when there was no epidemic among humans.
5. Human source G. lamblia can be established in laboratory Mongolian gerbils, Meriones unguiculatus, which will show an apparent self-cure in 2 or more months, and will be resistant to challenge infection for as much as 5 months after their initial infection.
6. Infections in gerbils will recrudesce as much as 7 months after initial infection in cortisone-immunodepressed gerbils.
7. Thus, the apparent sterile immunity to reinfection shown by "self-cured" gerbils probably is an actual "concomittant" immunity, or premunition.

7.0 Recommendations

The results presented in this report support several of the recommendations I have presented earlier, in the Final Report of my previous A.E.R.T. project, "Helminths of Dogs and Cats in Southern Alberta: Prevalence and Public Health Significance"; particular attention is drawn to recommendations 3, 7 and 11 in that report. In addition, the following recommendations are offered:

Recommendation 1: Prior to the time they are offered for sale to the public, unwanted animals at Animal Shelters should be examined by a veterinarian for infection, treated as appropriate, and re-checked if the infectious agent is capable of infecting humans; the costs for such examination and treatment should be paid by the fees for the sale of animals by shelters.

Rationale: "Shelter" animals constitute a "high risk" group in terms of prevalence of infection with a number of agents which can infect, or may be capable of infecting, humans. It is not appropriate for shelters to be vehicles for the dissemination of such animals back into the human population. It is the ethical, and perhaps the legal, responsibility of shelters to ensure that the unwanted animals which they provide do not constitute health hazards to their new owners, or others.

Recommendation 2: Shelter personnel should receive instruction in appropriate methods for disposal of animal wastes, for decontamination of cages and runs, and for avoiding exposure to infectious agents.

Rationale: Shelter personnel work with a transient, high turnover population of "high risk" animals, and their duties often place them in jeopardy of exposure to infectious agents.

Recommendation 3: Consideration should be given to monitoring the prevalence of Giardia infection, in dogs and possibly certain other potential reservoirs of human infection, in those areas where the potential for epidemic human outbreaks is known to occur.

Rationale: Results of this research suggest that dogs may serve as valuable indicators of the endemicity or epidemicity of Giardia in the environment. If so, collecting and monitoring canine stool samples would be far simpler and more economical than monitoring human samples. In fact, if recommendation #1 were carried out, the data could be obtained in large measure from veterinarians examining shelter animals.

8.0 Acknowledgements

This project could not have been undertaken without the assistance and cooperation of a good number of individuals. Ms Betty Golsteyn and Ms Susan Livingston spent many hours with me in 1980, examining dog stool samples to collect the pilot project data on which my first application to the A.E.R.T. was based. In 1981, Ms. Robin Weaver and Mr. Michael Knott worked on the "Southern Alberta" project; and in 1982, Ms Lesley Curthoys, Ms Paula Harper, Mr Joe Harrison and Mr Graham Skjenna were able student research assistants in the project which sampled major centres in the province. In 1983, Lesley and Joe continued this work and (when money ran out) Lesley kept working with me until we were finished.

I owe a considerable debt of gratitude to the Directors and, even moreso, to the Animal Shelter personnel, who kept our supply of dog and cat stools coming, provided information on the dogs, and responded most ably to our requests. I thank the Directors and Shelter Personnel of the Municipal Shelters in Lethbridge, Calgary, Red Deer, Edmonton and Medicine Hat; and of the S.P.C.A. Shelters in Calgary and Edmonton.

Finally, I thank the Alberta Environmental Research Trust for the financial support to conduct this work.

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TABLE 1: SUMMARY OF CANINE STOOL SAMPLES

LOCALITY	NUMBER OF SAMPLES COLLECTED	
	Municipal Shelters	S.P.C.A. Shelters
Edmonton	218	150
Red Deer	246	
Calgary	205	105
Lethbridge	81	
Medicine Hat	213	
All Centres	963	255
Total	1,218	

TABLE 2: PARASITES OF DOGS IN ALBERTA

	LETHBRIDGE	CALGARY	RED DEER	EDMONTON	MED.HAT	ALL
No. of Samples:	81	310	246	368	213	1218
SPECIES:						
<i>Giardia</i> sp.	27 (33%)	37 (12%)	17 (7%)	19 (5%)	2 (1%)	102 (8%)
<i>Isospora</i> spp.	5 (6%)	14 (5%)	14 (6%)	14 (4%)	5 (2%)	52 (4%)
taeniids	1 (1%)	2 (<1%)	3 (1%)	8 (2%)	0	16 (1%)
<i>Toxocara canis</i>	2 (2%)	16 (5%)	10 (4%)	22 (6%)	4 (2%)	54 (4%)
<i>Toxascaris leonina</i>	2 (2%)	19 (6%)	10 (4%)	45 (12%)	8 (4%)	84 (7%)
<i>Ascaris</i> sp.	0	2 (<1%)	0	4 (1%)	0	6 (<1%)
<i>Uncinaria stenocephala</i>	0	6 (2%)	12 (5%)	12 (3%)	0	30 (2%)
<i>Ancylostoma caninum</i>	0	3 (1%)	0	0	0	3 (<1%)
<i>Trichuris vulpis</i>	0	1 (<1%)	0	0	0	1 (<1%)
ALL INFECTIONS	33 (41%)	78 (25%)	58 (24%)	102(28%)	10 (5%)	281 (23%)

TABLE 3

GIARDIA SP. INFECTIONS IN ALBERTA DOGS

LOCALITY	STOOLS POS./EXAMINED	PREVALENCE
EDMONTON	19/368	5.4%
RED DEER	17/246	6.9%
CALGARY	37/310	11.9%
LETHBRIDGE	27/81	33.3%
MEDICINE HAT	2/213	0.9%
ALL COMMUNITIES	102/1218	8.4%

TABLE 4

**PREVALENCE OF *GIARDIA* SP. IN DOGS
FROM MUNICIPAL vs S.P.C.A. SHELTERS**

<u>CITY</u>	<u>MUNICIPAL SHELTER</u>	<u>S.P.C.A. SHELTER</u>
CALGARY	22/205 POS. = 10.7%	15/105 POS. = 14.3%
EDMONTON	7/218 POS. = 3.2%	12/150 POS. = 8.0%

TABLE 5

PREVALENCE OF *GIARDIA* SP IN EDMONTON MUNICIPAL SHELTER DOGS

	JUNE-AUGUST 1982*	FEBRUARY-MARCH 1983**
NUMBER OF SAMPLES:	218	99
NUMBER POSITIVE:	7	17
PREVALENCE:	3.2%	17.2%

* ZnSO_4 + MIF techniques; fresh stools

** ZnSO_4 only; SAF-preserved stools

TABLE 6
PARASITES OF CATS IN ALBERTA

COMMUNITIES:	LETHBRIDGE	CALGARY	EDMONTON	MED. HAT	ALL COMMUNITIES
No. of Samples:	44	92	53	46	235
PARASITES:					
PROTOZOA					
<i>Giardia</i> sp.	0	0	1 (1.9%)	0	1 (0.4%)
coccidians	4 (9.1%)	2 (2.2%)	4 (7.6%)	8 (17%)	18 (9%)
CESTODA					
taeniid tapeworms	1 (2.3%)	1 (1.1%)	1 (1.9%)	4 (9%)	7 (3%)
NEMATODA (round-worms)					
<i>Toxocara cati</i>	4 (9.1%)	1 (1.1%)	1 (1.9%)	3 (7%)	9 (4%)
<i>Toxascaris leonina</i>	0	1 (1.1%)	0	0	1 (0.4%)
ALL PARASITES:	8 (18.2%)	5 (5.4%)	6 (11.3%)	10 (22%)	29 (12%)

TABLE 7
CANINE GIARDIASIS

REFERENCE	POS/EXAMINED	PREVALENCE	LOCALITY
PRESENT STUDY	102/1218	8%	ALBERTA
CHOQUETTE and GELINAS (1950)	14/155	9%	QUEBEC
CATCOTT (1946)	20/113	18%	OHIO
CRAIGE (1948)	14/160	9%	CALIFORNIA
LEVINE and IVENS (1965)	7/175	4%	ILLINOIS

TABLE 8

CROSS-TRANSMISSION OF *GIARDIA LAMBLIA*

CYST SOURCE	RECIPIENT HOST	REFERENCE(S)
HUMAN	DOGS	KESSEL (1929) PADCHENKO & STOLYARCHUK (1970) DAVIES & HIBLER (1979)
	KITTENS	FANTHAM & PORTER (1916) KESSEL (1929)
	RATS	ARMAGHAN (1937) SEHGAL et al. (1976) DAVIES & HIBLER (1979)
	GERBILS	)
	GUINEA PIGS	)
	BEAVERS	DAVIES & HIBLER (1979)
	RACCOONS	)
	PRONGHORNS	)
	BIGHORNxMOUFFLON	)
HUMAN (culture)	DOGS	HEWLETT et al. (1982)
	GERBILS	BELOSEVIC et al. (1983)
WATER SUPPLY (and/or BEAVERS)	SPF BEAGLES	SHAW et al. (1977)
	GERBILS	BELOSEVIC & FAUBERT (198X)
BEAVERS	SPF BEAGLES	DAVIES & HIBLER (1979) DYKES et al. (1980)
	HUMANS (volunteers)	DAVIES & HIBLER (1979)
MULE DEER	HUMANS (volunteers)	DAVIES & HIBLER (1979)
RAT	HAMSTER	SAXE (1950)

EFFECT OF CORTISONE ON *GIARDIA LAMBLIA* INFECTIONS IN NAIVE GERBILS

Figure 1

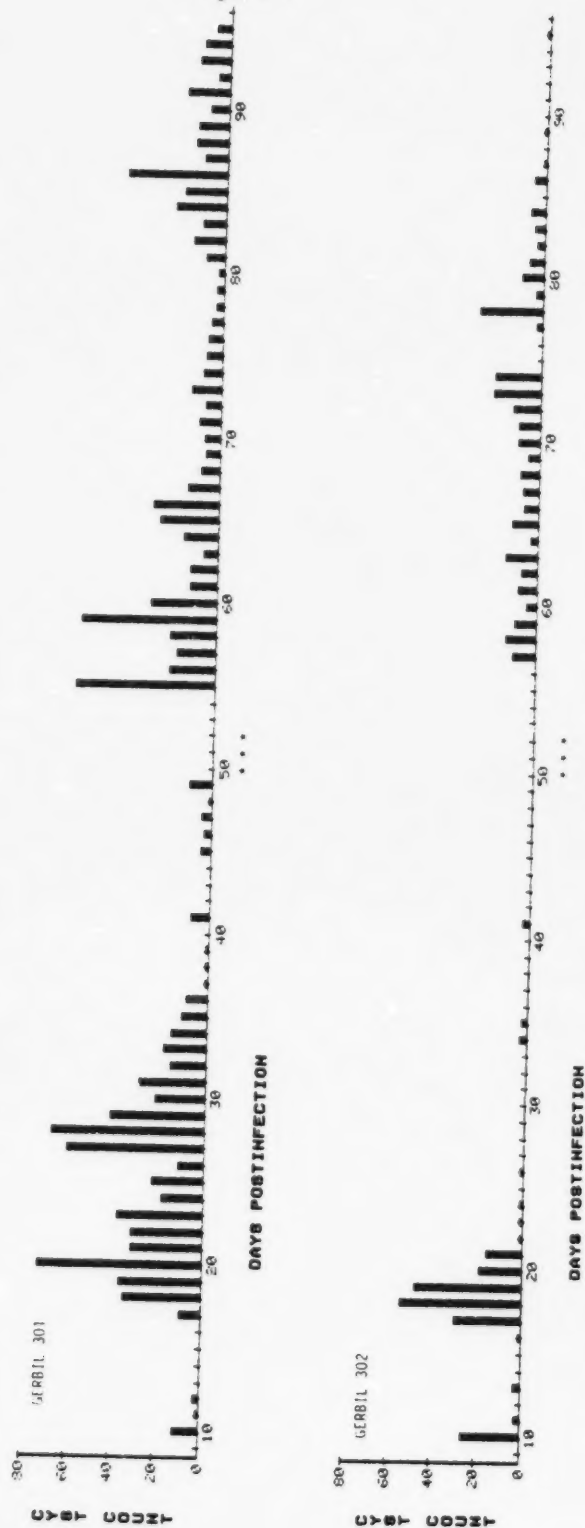


Figure 2

EFFECT OF CORTISONE ON GERBILS WHICH WERE RESISTANT
TO CHALLENGE INFECTION WITH *GIARDIA LAMBLIA*

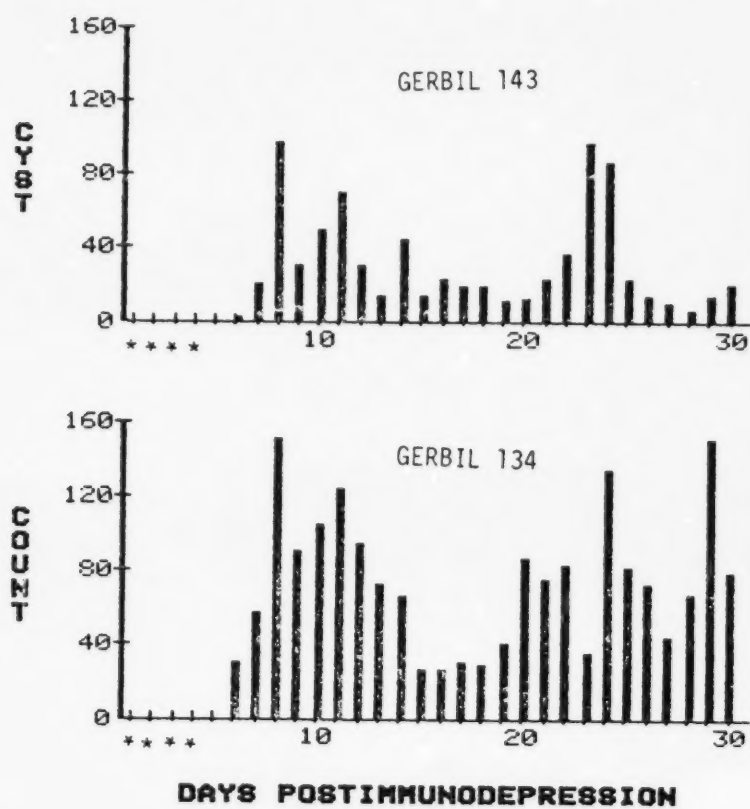


Figure 3

CORTISONE-TRIGGERED RECRUDESCENCE OF
GIARDIA LAMBLIA INFECTIONS IN GERBILS

